***Bixa orellana* L.** annatto
BIXACEAE

Synonym: *Bixa katagensis* Delpierre

General Description.—Annatto, which grows as a shrub or a small tree, is known by many other common names including lipstick plant, roucou, achiote, bija, urucú, and shambu (Little and others 1974). Its single or multiple stems are light brown. The bark is more or less smooth with many warty lenticels, but may become fissured in old individuals. If given ample space, annatto generally branches several times near the ground and develops a dense, spreading crown. The plant roots firmly with a thick taproot and finer laterals. The alternate leaves have long petioles, thin ovate blades with long-pointed tips. Panicles at the branch tips have few to many pink or white flowers. The fruits are spiny capsules that dry and split open in two parts to expose red seeds on their inner surfaces (Howard 1989, Liogier 1995).

Range.—Although annatto is native to continental tropical America, it is unclear where the original native stands of the species were located because the shrub has been cultivated since ancient times. It now grows in cultivation and naturalized from Mexico to Argentina and throughout the Caribbean Islands. The plant is also widely cultivated and naturalized in tropical and subtropical regions throughout the rest of the world.

Ecology.—Annatto is shade-intolerant and must have disturbance or a broken forest canopy to become established. All the naturally growing annatto shrubs in Puerto Rico are found on neglected or abandoned farmland, some of which has grown up to early secondary forest. Rainfall ranges from 1000 mm to 3000 mm per year in areas where the species grows naturally or under cultivation. Soils with textures from sands to clays are colonized. The species tolerates relatively low base saturation and moderate compaction. Anatto is vulnerable to overtopping and smothering by trees, shrubs, vines, and grass. Plants that have become overtopped and shaded cease to flower and bear fruit. The species is frost sensitive (von Carlowitz 1991).

Reproduction.—Annatto plants flower and fruit heavily and almost continuously in favorable habitat. Cuttings taken from flowering plants will produce flowers and fruits and a smaller shrub than plants of seed origin (Bailey 1941). Belfort and others (1992) report that seeds dried to moisture contents of 10 to 15 percent germinated at from 8 to 58 percent compared to fresh seeds (65 percent moisture) that gave 96 percent germination. Scarification was reported to improve germination of fresh seeds in another study. Mechanical scarification proved superior to acid or hot water treatments (Amaral and others 1995). Air-dry fruits collected in Puerto Rico weighed an average of 1.701 $\pm$ 0.078 g. Seeds from that collection averaged 0.029 $\pm$ 0.008 g/seed or 35,000 seeds/kg. Of these seeds that received no pregermination treatment, 60 percent germinated between 11 and 110 days after sowing. The resulting plants were ready to prick out (10 cm in height) about 3 months after germination. Success in air layering of shoots ranged from 93 to 100 percent except when sawdust was used as substrate (7 percent) (Barbosa e Silva and others 1993). Stem cuttings rooted (up to 60 percent) when treated with IAA or IBA. Untreated cuttings did not root (Thirunavoukkarasu and Saxena 1997). Annatto can be grafted by several techniques. The best method is budding (70 percent success in tests) (Bruckner and others 1991).

Growth and Management.—Annatto shrubs will bear fruit when 2 years old in Hawaii (Neal 1965). Under good management, plants will fruit within 1 year of planting (Nepstad and others 1991). An Indian plantation yielded 529 kg/ha of seed at 2 years old and 2,483 kg/ha of seed at 3 years old (Kanjilal and Singh 1995). Annatto seldom

reaches more than 5 m in height and 10 cm in stem diameter (Little and others 1974). Pruning of ornamentals is recommended to shape and thicken the crowns (Warren 1997).

Benefits.—Annatto, obtained from the oily arils of the seeds is the world's second most important (after caramel) natural colorant (Mercadante and Pfander 1998), yielding yellow to red colors. The colors are produced by several apocarotenoides and may reach up to 7 percent of the seed's dry mass (Katzer 1999). World production of annatto seed, both for commercial and home use, was estimated in 1990 at 10,000 tons per year (Arkcoll 1990). Brazil is the world's largest exporter (Katzer 1999). Not only was the dye used anciently to color food, but also to dye cloth and paint the skin (which is still done today). The species is also planted as an ornamental, particularly the varieties with bright pink pods. Branches with the dry pods are used in dry floral arrangements (Warren 1997). Bees collect nectar from its flowers to make honey. The wood is light-weight (specific gravity 0.4), weak, and not durable. It was used in former times to start fires by friction. Ropes and twine were made from the fibrous bark (Little and others 1974). The pulp surrounding the seeds is widely used in herbal medicine to treat burns, bleeding, dysentery, gonorrhea, constipation, and fever (Parrotta 2001). Extracts of leaves, bark, and roots are reported to be antidotes for poisoning from *Manihot esculenta* Crantz, *Jatropha curcas* L., and *Hura crepitans* L. (Liogier 1990).

References

Amaral, L.I.V., M. de F.A. Pereira, and A.L. Cortelazzo. 1995. Dormancy breaking in seeds of *Bixa orellana*. Revista Brasiliera de Fisiologia Vegetal 7(2): 151-157.

Arkcoll, D. 1990. New crops from Brazil. In: J. Janick and J.E. Simon, eds. Advances in new crops. Timber press, Portland, OR. p. 367-371.

Bailey, L.H. 1941. The standard cyclopedia of horticulture. Vol. 1. The MacMillan Co. New York, NY. 1,200 p.

Barbosa e Silva, K.M., F.C.G. Almeida, F.A.G. Almeida, P.S. Lima e Silva, J.J.L. de Albuquerque, and J.J.L. de Albuquerque. 1993. Effect of substrate on rooting of air-layered shoots of annatto. Pesquisa Agropecuaria Brasileira 28(1): 101-106.

Belfort, A.J.L., O.R. Kato, and M. do S.A. Kato. 1992. Practical method of drying annatto seeds for seedling production. Circular Tecnica 67. Centro de Pesquisa Agropecuaria do Tropico Umido, EMBRAPA-CPATU, Belem, Brazil. 14 p.

Bruckner, C.H., S.S. Khouri, and A.V. Melgaco. 1991. Propagation of annatto (*Bixa orellana* L.) by five grafting methods. Revista Ceres 38: 218, 340-344.

Howard, R.A. 1989. Flora of the Lesser Antilles. Vol. 6. Arnold Arboretum, Harvard University, Jamaica Plain, MA. 658 p.

Kanjilal, P.B. and R.S. Singh. 1995. Agronomic evaluation of annatto (*Bixa orellana* L.). Journal of Herbs, Spices, and Medicinal Plants 3(3): 13-17.

Katzer, G. 1999. Annatto (*Bixa orellana* L.). http://www-ang.kfunigraz.ac.at/~katzer/engl/Bixa_ore.html. 3 p.

Liogier, H.A. 1990. Plantas medicinales de Puerto Rico y del Caribe. Iberoamericana de Ediciones, Inc., San Juan, PR. 563 p.

Liogier, H.A. 1995. Descriptive flora of Puerto Rico and adjacent islands. Vol. 4. Editorial de la Universidad de Puerto Rico, San Juan, PR. 617 p.

Little, E.L., Jr., R.O. Woodbury, and F.H. Wadsworth. 1974. Trees of Puerto Rico and the Virgin Islands. Vol. 2. Agriculture Handbook 449. U.S. Department of Agriculture, Washington, DC. 1,024 p.

Mercadante, A.Z. and H. Pfander. 1998. Carotenoids from annatto: a review. Recent Research Developments in Agriculture and Food Chemistry 2(1): 79-91.

Neal, M.C. 1965. In gardens of Hawaii. Special Publication 50. Bernice P. Bishop Museum Press, Honolulu, HI. 924 p.

Nepstad, D.C., C. Uhl, and E.A.S. Serrao. 1991. Recuperation of a degraded Amazonian landscape: forest recovery and agricultural restoration. Ambio 20(6): 248-255.

Parrotta, J.A. 2001. Healing plants of Peninsular India. CAB International, Wallingford, UK. 944 p.

Thirunavoukkarasu, M. and H.O. Saxena. 1997. A short note on the effect of auxins (IAA, IBA) on rooting of *Bixa orellana* L. stem cuttings. Orissa Journal of Horticulture 25(1): 84-86.

von Carlowitz, P.G. 1991. Multipurpose trees and shrubs, sources of seeds and inoculants. International Council for Research in Agroforestry, Nairobi, Kenya. 328 p.

Warren, W. 1997. Tropical plants for home and garden. Thames and Hudson, New York. 240 p.

John K. Francis, Research Forester, U.S. Department of Agriculture, Forest Service, International Institute of Tropical Forestry, Jardín Botánico Sur, 1201 Calle Ceiba, San Juan PR 00926-1119, in cooperation with the University of Puerto Rico, Río Piedras, PR 00936-4984